B1

1. A fluid dispenser for dispensing a fluid onto a substrate comprising:

a dispensing valve movable between open and closed positions for controlling a flow of the fluid from said fluid dispenser;

a solenoid, the operation of said solenoid being effective to cause said dispensing valve to move between the open and closed positions;

a power supply having an output voltage; and

a driver circuit electrically connected to said solenoid and said power supply and providing an output signal to said solenoid having an initial peak current with a variable duration followed by a hold current, the duration of said initial peak current varying as a function of the output voltage of said power supply.

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2. The fluid dispenser of claim 1 wherein said driver circuit automatically varies the duration of said initial peak current as a function of the output voltage of said power supply.

3. The fluid dispenser of claim 2 wherein said driver circuit automatically varies the duration of said initial peak current as an inverse function of a magnitude of the output voltage of said power supply.

4. The fluid dispenser of claim 1 further comprising a peak current duration control connected to said power supply and providing a signal varying as a function of the output voltage of said power supply.

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16. A method of operating a fluid dispenser for dispensing a fluid onto a substrate, the fluid dispenser having a dispensing valve being movable between open and closed positions for controlling a flow of the fluid from the fluid dispenser, a solenoid having a coil in electromagnetic communication with an armature being movable through a displacement by energizing the coil, the operation of the solenoid being effective to cause the dispensing valve to move between the open and closed positions; the method comprising:

providing a power supply having a voltage;

producing an output signal having an initial peak current with a variable duration followed by a hold current, the duration of the initial peak current varying as a function of the voltage of the power supply; and

applying the output signal to the coil of the solenoid, thereby automatically changing the operation of the dispensing valve as a function of the voltage of the power supply.

B3

19. A method of operating an electrically operated fluid dispenser for dispensing a fluid onto a substrate, the fluid dispenser having a dispensing valve operatively connected to an electrically operated solenoid, the dispensing valve being movable between open and closed positions for controlling a flow of the fluid from the fluid dispenser, the method comprising:

providing a power supply having a voltage;

producing an output signal having an initial peak current with a variable duration followed by a hold current, the duration of the initial peak current varying as a function of the voltage of the power supply; and

applying the output signal to the electrically operated solenoid, thereby automatically changing the operation of the dispensing valve as a function of the voltage of the power supply.

B4

21. The method of claim 19 further comprising producing the initial peak current with a duration varying as an inverse function of the voltage of the power supply.

22. The method of claim 19 further comprising:

producing a feedback signal representing current in the solenoid; and

producing the hold current as a function of the feedback signal.

B4

23. A method of operating an electrically operated fluid dispenser for dispensing a fluid onto a substrate, the fluid dispenser having a dispensing valve operatively connected to an electrically operated solenoid, the dispensing valve being movable between open and closed positions for controlling a flow of the fluid from the fluid dispenser, the method comprising:

producing a first output signal having an initial peak current with a variable duration followed by a hold current, the duration of the initial peak current varying as a function of a first nominal voltage of a first power supply connectable to the fluid dispenser;

applying the first output signal to the solenoid;

producing a second output signal having an initial peak current with a variable duration followed by a hold current, the duration of the initial peak current varying as a function of a second nominal voltage of a second power supply connectable to the fluid dispenser in place of the first power supply; and

applying the second output signal to the solenoid.

Remarks

Claims 5-15, 17, 18, 20, 24 and 25 have been canceled, and claims 1-4, 16, 19, 21-23 have been amended. Claims 1-4, 16 and 19, 21-23 remain in the application, and re-examination and reconsideration of the application are respectfully requested. Applicant appreciates the indication of allowable subject matter in the claims.

Claims 4 and 23 are rejected under 35 U.S.C. §112, second paragraph, for reasons stated in the Office Action. Claims 4 and 23 have been amended, and Applicant submits that the rejection of claims 4 and 23 should be withdrawn.

Claims 1-4, 16 and 19-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Nojima in view of Oyama et al. Nojima relates to an electric gun driver for controlling a solenoid with a fluid dispenser. Referring to Fig. 1, a gun driver 10 operates with different line voltages ranging from 100-240 volts AC and at frequencies of 50-60 Hz. A switch mode power supply 18

receives a wide range of line voltages 19 and generates an isolated supply voltage 20 for use by a microcontroller 40 within a control circuit 11. The microcontroller 40 provides a current reference signal on an output 44 connected to a hysteresis band modulator 46 that receives a current feedback signal on an input 48. The current feedback is adjustable by the microcontroller 40 via output 90, and the current reference signal is determined by the microcontroller 40 as a function of operator selectable inputs. For example, the operator can designate the duration of the pull-in or peak current and the duration of the hold current, so that the gun operation can be adapted to different fluid viscosities and other application variables. The hysteresis band modulator 46 modulates the operation of the transistor switch 54, so that a desired drive current is supplied to the solenoid 14 of the dispenser 12 independent of the magnitude of the line voltage 19. The duration of the pull-in or peak current is selectable by the operator and is not affected by the magnitude of the line voltage.

Oyama et al. relates to an electromagnetic coil drive device that is capable of powering an electromagnet in response to power supply voltages in a range of from 100-200 volts. Referring to Fig. 1, current is provided to a coil 4 by a series of pulses provided to a switch 5. The pulse widths are modulated as an inverse function of the power supply voltage as shown in Fig. 5, thereby providing a substantially constant pull-in or peak current to the coil 4 independent of the power supply voltage. The pulse width modulation is provided by a closing level signal SLa that has a magnitude proportional to the voltage of the power supply 1. The closing level signal is compared to a sawtooth signal in a comparing circuit 12 (Fig. 3); and the comparing circuit 12 provides a pulse Pa for turning off the switch 5. The switch 5 has a duty cycle inversely proportional to the power supply voltage. Thus, the higher the power supply voltage, the shorter the pulse width of the pulse Pa and, the shorter the on-time of the switch 5. In a similar manner, a holding level signal Slb is used to control the duration of the hold current. As shown in Figs. 5d, 5g and 5j, the coil is driven by a desired current signal independent of the magnitude of the power supply voltage.

The duration of the pull-in or peak current is a predetermined period of time that, referring to Fig. 2, is provided by a fixed delay determined by R (93), C(95) and regulated voltage (16). Thus, the duration of the peak current is not varied as a function of the power supply voltage.

Applicant submits that the combination of Nojima and Oyama et al. fails to provide a prima facie obviousness rejection. In order to establish a prima facie case of obviousness, it is necessary that the Office Action present evidence, preferably in the form of some teaching, suggestions, incentives or inference in the applied prior art or, in the form of generally available knowledge, that one having ordinary skill in the art would have been led to arrive at the claimed invention.

A prima facie case of obviousness is not made because Nojima and Oyama et al. neither alone nor in combination disclose or suggest the claimed inventions. Each of the independent claims requires an output signal having an <u>initial peak current with a variable duration</u> followed by a hold current, wherein the <u>duration of said initial peak current varies as a function of the power supply voltage</u>. As described at page 10, line 11 through page 13, line 5 and elsewhere, referring to Fig. 4, the PWM 130 is operated at a set, for example, 100%, duty cycle for the duration of the peak current. A delay circuit 132 controls the duration of the peak current as an inverse function of the power supply voltage. Thus, the greater the power supply voltage, the shorter the duration of the peak current. At the end of the peak current duration, the duty cycle of the PWM 130 is reduced to provide the hold current to the solenoid.

In Nojima, the pull-in or peak current duration is selectable by the operator, but once selected, is fixed during the operation of the solenoid. no, it is not

Similarly, in Oyama et al., the pull-in or peak current duration is fixed. Both Nojima and Oyama et al. provide pulses of varying widths that govern operation of a switch as a function of changes in the line or power supply voltage. Thus, in both Nojima and Oyama et al., the duty cycle of the switch is modulated as a function of changes in the line or power supply voltage. In contrast to the operation of the cited references, with the claimed inventions, the duration of the

pull-in or peak current is changed as a function of the power supply voltage; and the duty cycle of a PWM remains fixed during the pull-in or peak pulse duration.

Further, a prima facie case of obviousness is not made because there is nothing in Nojima or Oyama et al. to suggest their combination. Nojima relates to an electric gun driver for controlling a solenoid with a fluid dispenser that is operable with different line voltages ranging from 100-240 volts AC and at a frequency of 50-60 Hz. Oyama et al. relates to an electromagnetic coil drive device that is capable of powering an electromagnet in response to power supply voltages in a range of from 100-200 volts. Thus, both Nojima and Oyama et al. provide drive circuits for an electromagnetic coil that are operable with different line or supply voltages. Both Nojima and Oyama et al. provide pulses of varying widths that govern operation of a switch as a function of changes in the line or power supply voltage. There is nothing in either Nojima or Oyama et al. to suggest that the hysteresis band modulator and associated drive circuit be replaced by the drive circuit of Oyama et al. or that such a replacement would provide the variable peak current duration of the claimed inventions.

Therefore, Applicant submits that claims 1-4, 16 and 19-23 are patentable and not obvious under 35 U.S.C. §103(a) over Nojima in view of Oyama et al.

Claims 1-4, 16 and 19-23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Nojima in view of Ohtsuka. Ohtsuka relates to a method of controlling an electromagnetic contactor, wherein the contactor is capable of recognizing and operating with different power supplies, for example, 100 volt or 200 volt, AC or DC power supplies. As shown in Fig. 4, a pulse width modulation is used to control the desired value of peak current; however, the duration of the peak current T_1 is fixed and controlled by a timer circuit 16. Thus, in that regard, Ohtsuka is similar to both Nojima and Oyama et al. Applicant submits that the above arguments relating to the patentability of claims 1-4, 16 and 19-23 with respect to the combination of Nojima and Oyama et al. apply equally to the combination of Nojima and Ohtsuka. Therefore, Applicant submits

that claims 1-4, 16 and 19-23 are patentable and not obvious under 35 U.S.C. §103(a) over Nojima in view of Ohtsuka.

Claims 1-4, 16 and 19-21 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 4 of copending Application Serial No. 09/880,649. Claim 4 recites a control circuit that provides an initial peak with an initial duty cycle varying as an inverse function of the variations of the nonconstant voltage of said power source. As described at page 11, lines 14-34 of the copending application, a duty cycle control reduces the duty cycle of a PWM as a function of an increase in the power supply voltage. The lower duty cycle reduces the effective voltage supplied to the coil over the duration of the initial peak current; however, the duration of the peak current, that is, T_{PK}, remains constant. Claims 1-4, 16 and 19-21 require a peak current having a variable duration. Therefore, Applicant submits that claims 1-4, 16 and 19-21 are patentable over claim 4 of copending Application Serial No. 09/880,649 and, that the provisional rejection under the judicially created doctrine of obviousness-type double patenting should be withdrawn.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to Show Changes Made."

Applicant submits that the claims remaining in the application are allowable, and the Examiner is invited to call the undersigned attorney should any questions arise.

Respectfully submitted,

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